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What is claimed is:

1. A method for forming multi-layer wiring structure, wherein a lower wiring layer and an upper wiring layer are electrically connected through a via hole, comprising following
5 steps:

forming an organic SOG layer directly or through a predetermined film including a hillock protection layer on said lower wiring layer;

forming said upper wiring layer on said organic SOG layer
10 without processing of etching back;

forming a via hole through etching process by using a patterned resist layer provided on said upper wiring layer as a mask;

conducting ashing process with a plasma by making ion or
15 radical which is induced from oxygen gas as a main reactant, under an atmosphere of pressure ranging from 0.01 Torr to 30.0 Torr; and

burying said via hole with a conductive body so as to electrically connect between said lower wiring layer and said
20 upper wiring layer.

2. A method for forming multi-layer wiring structure as defined in Claim 1, wherein carbon content of said organic SOG layer lies between 5 through 25 in atomic weight %.

3. A method for forming multi-layer wiring structure as
25 defined in Claim 1 or 2, wherein a coating liquid for forming said organic SOG layer contains a compound, which is obtained through hydrolysis and condensation of at least one being

selected from alkoxysilane compounds into an organic solvent under existence of an acid catalysis, being expressed by a following equation:

general equation: $R_nSi(OR^1)_{4-n} \dots\dots (I)$

5 where, R is alkyl of carbon number from 1 to 4 or aryl group, R^1 is alkyl group of carbon number from 1 to 4, and n is an integer of 1 or 2.

4. A method for forming multi-layer wiring structure as defined in Claim 3, wherein the coating liquid for forming said
10 organic SOG layer includes hydrolysis-and-condensation product which is obtained by reacting monoalkyltrialkoxysilane of 0.5 through 4 mol upon tetraalkoxysilane of 1 mol.

5. A method for forming multi-layer wiring structure as defined in Claim 3, wherein the coating liquid for forming said
15 organic SOG layer includes hydrolysis-and-condensation product which is obtained by reacting tetraalkoxysilane of 0.5 through 4 mol and monoalkyltrialkoxysilane of 0.5 through 4 mol upon dialkyldialkoxysilane of 1 mol.

6. A method for forming multi-layer wiring structure as
20 defined in Claim 3, wherein the coating liquid for forming said organic SOG layer includes ladder-type hydrolysis-and-condensation product which is obtained from monoalkyltrialkoxysiran.

7. A method for forming multi-layer wiring structure,
25 wherein a lower wiring layer and an upper wiring layer are electrically connected through a via hole, comprising following steps:

forming a SOG layer being formed from coating liquid containing polysilazane, directly or through a predetermined film including a hillock protection layer on said lower wiring layer;

5 forming said upper wiring layer on said SOG layer formed without processing of etching back;

forming a via hole through etching process by using a patterned resist layer provided on said upper wiring layer as a mask;

10 conducting ashing process with a plasma by making ion or radical which is induced from oxygen gas as a main reactant, under an atmosphere of pressure ranging from 0.01 Torr to 30.0 Torr; and

15 burying said via hole with a conductive body so as to electrically connect between said lower wiring layer and said upper wiring layer.